

TABLE XXV. *Synopsis of origin of Coco Island flora.*

Species possibly introduced, for the presence of which no former land connection need be necessary:—.....	288
Introduced by living creatures	127
By human agency; (largely cosmopolitan species)	33
Intentionally; (cultivated plants)	15
Unintentionally; (weeds)	18
By birds, (perhaps also to a small extent by bats)	94
Attached externally to their bodies	25
Immediately; (viscous- or prickly-fruited sp.)	9
By mud; (species introduced by water-birds, mainly from the northward)	16
Carried in crops of birds; (almost in equal proportion from northward and from southward)	69
As a natural sequence of their mode of life; (fleshy-fruited species)	55
Accidentally, where bird must have been destroyed to admit of germination of seeds; (by seed- and grain-eating birds): [indirectly due to agency of wind]	14
By other natural agencies	161
By wind directly; (sp. with seeds specialised for wind-carriage; also small-spored <i>Cryptogams</i>)	60
By the sea; (mainly Malayan species)	101
Marine species; (mainly <i>Algæ</i>)	21
Littoral species; (mangrove-vegetation and beach-forest species)	80
Species probably remanent and indicating former connection with adjacent land, (apparently Indo-China):—.....	70
TOTAL of Coco Island species	358

Notes on some native Ephemeroïdæ in the Indian Museum, Calcutta.—

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THE SUPERINTENDENT OF THE INDIAN MUSEUM.

[Received 17th November, 1891: Read 2nd December, 1891.]

The following notes concern a collection of 27 specimens of *Ephemeroïdæ* received from Calcutta in April 1889, comprising representatives of 10 species or 6 genera, viz.:—3 sp. of *Palingenia*, 1 of *Polymitarcys*, 1 of doubtful genus allied to *Hexagenia*, 2 of *Ephemerella* and 2 of *Epeorus*,—all of ordinary dimensions. From the absence of lesser species it may be inferred that these are the results of random

captures rather than of careful collecting. A series of 21 specimens from the Tenasserim valley, in Mr. McLachlan's collection, yields representatives of 9 species in 8 genera, all (except one) of small size, and some of them remarkably beautiful.

PALINGENIA LATA, Walker.

Seven adult ♂ specimens, labelled respectively "Sibs $\frac{6306}{1}$ to $\frac{6311}{1}$,"¹ Their wings are in a very slight degree warmer in tint than the "light vandyke brown" of the typical specimens in the British Museum, and vary in unimportant detail from the wing-neruration figured in Trans. Lin. Soc. London, 2nd series, Zool. iii. pt. i. 1 b (1884). Fore tarsus ♂ rather shorter than the tibia: joint 1 short, 2 or 5 the longest, 3 subequal to 4; unguis nearly of one length, each with a minute hook. For other particulars *vide op. cit.* p. 26. This is the only dark-winged species found hitherto in Hindostan.

The next two species have wings of a light colour.

PALINGENIA ROBUSTA sp. nov.

Two adult ♂ specimens labelled "Cachar;" both mutilated and perhaps faded. Wings defective, brownish white, dusky where bruised, their stronger nervures light, raw umber brown, the weaker nervures paler; neruration similar in style to that of *P. lata*, but with fewer and more distant veinlets distributed to the hinder half of the terminal margin. Head and notum light raw umber brown, the former blackish around the ocelli: pronotum varied with blackish or dusky markings comprising,—in front, an impressed sinuate transverse line ending opposite the middle of the backs of the eyes,—on each side, the border of a protuberance in front of the deep lateral depression,—behind a fine line along the transverse crease at the hind margin. Pleura, sternum, femora and fore tibiæ, dull, light yellowish brown (intermediate in tint between raw umber and brown ochre); fore tarsus and hinder tibiæ and tarsi paler or duller in colour, and transversely rugose: a short dusky line on the mesopleuron, between the root of the costa and the spiracle. Dorsum faded: the last 3 or 4 segments largely suffused with light, raw umber brown, the anterior segments less and less so; the joinings sometimes pale. Venter and forceps dull, light, yellowish brown. Setæ dirty whitish yellow, uniformly pilose. Fore tarsus shorter than the tibia: joint, 1 short; 2 subequal to, or very little longer than 5, 3 shorter than 5 but subequal to 4; unguis nearly of one length. Hinder

¹ Presented to the Indian Museum by Mr. S. E. Peal, and collected in Sibsagar, Assam.

tarsi uni-unguiculate. Terminal jointlets of the forceps-limbs nearly of one length, or the last a little longer. Length of body 25 m. m.

POLINGENIA MINOR, sp. nov.

Three adult ♂ specimens much damaged by cabinet pests: 2 labelled "Karachi Mus." and 1 labelled "Nattor." Wings dull white, with sub-opaque neuration; under a lense, in some lights, the cross-veinlets are bordered with milk-white. Neuration fairly comparable to that of *P. ampla* (cf., Trans. Linn. Soc. London, 2nd Series, Zool. iii. pl. i. 1 c) but with the veinlets that end in the posterior half of the terminal margin shorter. Head brown ochre, blackish around the ocelli. Mesonotum light brown ochre, darker than the pronotum. Legs from some stand-points concolorous with the venter, the tarsi and hinder tibiæ shifting, with change of posture, to whitish. Colouring of abdomen effaced by pests, in the larger (Karachi) specimens; in the smaller (Nattor) one the dorsum is whitish ochre with whitish joinings anteriorly, but posteriorly is very light brown ochre, clouded in segments 6 and 7 to a small extent, and to a larger extent (half across the back) posteriorly in segments 8 and 9 with dark grey. Setæ extremely light brownish ochre in tint, uniformly pubescent. Fore tarsus little shorter than the tibia: joint 1 short, 5 rather longer than 2, 3 subequal to or little shorter than 2 and rather longer than 4; tibiæ and tarsi finely and transversely rugose. Terminal jointlets of the forceps-limbs of one length in the Nattor specimen, but in those from Karachi Mus. the last jointlet is rather the longer. Length of wing (Karachi exempl.) about 17, setæ about 50 m. m.

POLYMITARCYS sp.—

A single fragmentary ♀ of undescribed species, labelled "Raneeganj." In this genus discrimination is at present unsatisfactory owing to the meagreness of published descriptions. The specimen now under consideration differs from *P. indicus*, Piotet, in the colouring of the thorax and hinder legs. Whether his species can ever be identified is excessively doubtful in the absence of precise record of locality of capture. Reference to the "East Indies" as the domicile of an insect is of little use to any but the general reader.

Genus——(unascertainable).

One defective ♀ subimago labelled "Sibs. S. E. P.," lacking the fore legs and the last 3 segments of the body, and having the fore wings badly folded up out of shape. This insect, judging from the wings,

should be ranked as one of the *Ephemera Type*. The costal shoulder of the hind wings is rounded off obtusely, just as in *Hexagenia*, but the pronotum resembles that of a *Pentagenia*. Precise identification of the genus is precluded by the ruinous condition of the specimen.

Until now only three species of *Ephemera* have been described from India,—*E. immaculata*, Etn., from Cuna, *E. expectans*, Walker, from "Hindustan," and *E. supposita*, Etn., from Ceylon. Of these the first has no abdominal markings, but the others have linear dorsal and ventral markings. Two other species of Indian Mayflies, also with linear markings, have long been represented by single specimens in Mr. McLachlan's cabinet; and in the present collection there is sufficient additional material for their description. They are nearly related to *E. supposita*, which therefore may advantageously be treated of in this paper, although wanting in the Calcutta Museum.

EPHEMERA SUPPOSITA, Eaton.

Described from ♀ subimago in Baron E. de Selys-Longchamp's Museum; 1 ♂ im. in McLach. Mus.; compared with the ♀ subim. standing with the type-specimen of *Potamanthus* [= *Atolophlebia*] *fasciatus* in Hagen's collection, and with ♂ specimens in the British Museum: cf. Trans. Linn. Soc. London, 2nd Series, Zool. iii. 73, pl. viii. 12^c (1883) or [for pattern of dorsal markings] Trans. Ent. Soc. London, (1871) p. 75. The following notes are supplementary to these earlier descriptions of the ♂ imago.

Neuration of the forewing distinct to the unaided eye when held over white paper, with perhaps the exception of only the branchlets of the intercalar veins annexed to the anal nervure; over a dark background, when viewed under a lense facing the light, the radius and the stronger parts of the subcosta of the forewing, and the cross veinlets in both wings remain dark, but the other nervures become pale; in transmitted light the nervures assume an amber tint. Membrane of the forewing (excepting the distinctly coloured parts) perfectly transparent in direct view: but held obliquely at a moderate distance, fronting the light, the finer of the longitudinal nervures transmit to it a faint yellowish grey; or pointing towards the light, the cross veinlets transmit to it a faint reddish grey: in proximity to the costa, the pterostigmatic portion of the marginal area is rather deficient in colour. I was probably mistaken in 1883 when I described the dorsal vessel as dark; but the ravages of cabinet pests preclude certitude on this point.

The dorsal abdominal markings of the best marked segments comprise six black longitudinal stripes or streaks united to one another by the burnt umber brown apical border of the segments,—three on each

side of the back. In segments 9 to 7 two of the streaks, linear and sub-parallel with each other, lie close together beside the dorsal vessel, extending the whole length of the segment (the outer streak is rather broader than the other), while the third streak lies apart from them close by the pleuron. In the more anterior segments (*e. g.*, in the 3rd segment) the main trachea in front of the spiracle is dark, and the three streaks, in mutual contact at the apical margin, constitute a tripartite marking: the streak nearest to the dorsal vessel becomes abbreviated and subulate, but the other two combining either in the form of a V or as a pair of conjugate triangular streaks, extend nearly to the base of the segment. In the first segment, a quadrangular spot seems to be substituted for the streaks: the 9th ventral segment is bilineate lengthwise.

Terminal jointlets of the forceps-limbs short for an *Ephemeræ*; the last of them smaller, but little if at all shorter than the penultimate. The figure of 1883, cited above, is exact, and correctly leaves their proportions in the dried insect uncertain. Penis lobes subcylindrical. The admeasurement of setæ of ♀ im. stated in 1871 [*cf. E. faciata*] was spurious, being based upon a specimen of the next species, referred to in 1883 with an expression of doubt as to identity of the species.

Hab. Rainbodde, Ceylon.

EPHEMERA REMENSA, sp. nov.

Five ♂ imagos labelled "Kulu $\frac{6942\text{'4, \& '6, \& '8}}{1}$," in Indian Museum;

and 1 ♀ imago labelled "Musuri," 7,000 ft., June, Long, in McLach. Mus.

Imago (dried) ♂.—Genitalia similar to the ordinary European pattern in this genus: the last jointlet of the forceps-limb rather shorter than the penultimate. A pair of very broad black stripes, diminishing a little in breadth anteriorly, extend from the tip nearly to the base of the 9th ventral segment and end abruptly: the other ventral segments are bilineate longitudinally, excepting the first segment which is unmarked. Neuration of the fore wing distinct to the naked eye throughout (over white paper) excepting the branchlets of the intercalar veins annexed to the anal nervure, and the base-ward extremities of the longitudinal nervures posterior to the radius: under a lense, the portions thus visible, and the neuration of the hind wing, from certain standpoints only, appears of a uniform light pitch brown, but in most positions the finer of the longitudinal nervures acquire a brown amber tint, the stronger neuration and the cross veinlets remaining pitch brown or changing to pitch black. Wings transparent, tinted distinctly with very light raw umber grey throughout, with markings of raw umber brown. The markings of the fore wing comprise the submarginal area

together with the extremity of the area next behind it, and narrow cloudy bordering along the subcosta in front and the radius behind (the former more extensive in the beginning of the pterostigmatic space) as well as along the cross veinlets; in addition to spots: in this sex the spots are larger than in the ♀ (but not much larger) and therefore are hardly so small as in *E. supposita*; the best marked are three in the usual positions in the midst of the wing, viz:—one at the præbrachial fork and the others on the cubitus and the first sector, but occasionally cross veinlets or the ends of nervures are clouded in the usual places of other spots found in species of *Ephemeræ*, such as at the inner ends of the shortest of the sectorial intercalar nervures, or at the junction of the pabrachial with the 2nd or 3rd cross veinlet beyond the fork of the præbrachial nervure, or near the base of the wing between the pabrachial and anal nervures either on the nearest cross-veinlet or at the extremity of the foremost intercalar nervure. The terminal margin of the hind wing is narrowly bordered with a light, raw umber grey cloud and several of the cross veinlets are pitch black.

The abdominal markings resemble those of *E. supposita* in most respects: those of the 1st segment are not well shewn in the specimens at hand: the 2nd segment in place of dorsal streaks has on each side an irregular transverse quadrangular blotch, narrowed upwards and obliquely truncate above; the 3rd to the 5th segments have two streaks and the 6th to the 8th segments three dorsal streaks on each side, all longitudinal and sub-parallel, the lowest of which is linear and narrow, the next to it double the width and usually more curved, and the innermost (where there are three) narrow and tapering at both ends. In the 9th segment a broad stripe takes the place of the lowest and the intermediate streak combined. On the pleura, in nearly every segment, is a short black dash at the base; but the 10th segment has a black blotch. Setæ light raw umber brown; the joinings mostly (excepting in the basal half of the median seta) narrowly dark brown. Fore femur in opaque view either raw umber brown or rufo-piceous: tibiæ dark pitch brown; tarsus lighter; trochanter and coxa subochreous. Hinder legs in opaque view, translucent yellow ochre, with the obtuse claw pitch brown. In transmitted light, the fore femur and tarsus become ferruginous amber, and the hinder legs yellow amber.

♀ Very similar to the ♂. Thorax brown ochreous, with a black spot in front of each tegula, a black longitudinal stripe on each side of the pronotum, and a black irregular line down the outer side of the fore coxa. Fore femur brown ochreous; fore tibiæ bistre brown or light pitch brown; fore tarsus paler. Wings nearly colourless, with indistinct and minute spots, placed singly at the bulla of the sub-costa, behind

that on the cubitus, and at the fork of the præbrachial; another further out on the pobrachial; and one near the base of the fore wing at the commencement of the next intercalary vein. Hindwings spotless or with spots only faintly indicated.

Length of body ♂ 15, ♀ 18; wing ♂ 13-15, ♀ 21; setæ ♂ im. 26 & 28 to 30 & 34 m. m.

EPHEMERA CONSORS, sp. nov.

Two ♂ imagos labelled "Kulu $\frac{5854}{5}$ and $\frac{5855}{5}$," and two ♀ subimagos labelled "Kulu $\frac{5852}{5}$ and $\frac{5853}{5}$ " in the Indian Museum; and 1 ♀ subimago labelled "Sikkim, 4,000 feet, 7 [*i. e.*, July] 80, H. J. Elwes, in McLachl. Mus."

Subimago (dried) ♀.—Wings transparent, very faintly tinted with extremely light brown ochreous grey, or in the sub-marginal area of the fore wing with very light amber, with a small, blackish grey spot at the fork of the præbrachial nervure, another at the bulla of the sub-costa, and single greyish dots nearly in a straight line with them on the sector and cubitus of the fore wing. Hind wing spotless. Neuration of the fore-wing distinct to the naked eye (over white paper) from the costa to the sector, and then hardly discernible onwards to the pobrachial nervure: after that the minor neuration and the neuration of the hind wing cannot be distinguished. When magnified, the neuration of the hind wings and of the greater portion of the fore-wing is opaque and concolorous with the membrane: but many of the cross veinlets in the basal half of the wing shift in colour to piceous in certain postures, and all of them (excepting the greater cross-vein) anterior to the sector are pitch black. The pronotum is marked as in *E. remensa*, with a small oval black spot anteriorly on each side in a furrow: and in both species there is a small acute triangular black spot in front of the posterior coxa.

Imago (dried) ♂.—Terminal jointlets of forceps proportionally longer than in *E. remensa*, and more slender; the last jointlet shorter than the penultimate in the dried specimen: basal joint relatively short. Venter bilineate lengthwise interruptedly in the posterior segments: the lines are narrow and as far apart from each other in the 9th as in the preceding segments, and in the 5th, 4th and perhaps the 3rd segments become greatly abbreviated or even reduced to dots; but the 2nd and 1st segments are spotless. Wings much as in the ♀ subimago, but of course more transparent: the spots in the fore wing are similar but less distinct; the greater part of the neuration is (in opaque view) light raw umber brown changing (in transmitted light) either to brown-

ish amber or (in the finer parts) to very light or whitish amber; but where visible without a lense, the cross veinlets when magnified appear pitch black or pitch brown in opaque view, and this colour remains fairly constant from most stand-points; the subcosta and radius and also in some positions the great cross vein are likewise piceous. Hind wing spotless, and clear throughout. Fore leg raw umber brown, blackened at the tip of the femur and at the base and tip of the tibia. Hinder legs light yellowish amber colour.

Abdomen pale ochraceous or whitish raw umber grey in the first 5 segments, and light brownish ochre in the hinder segments, marked with black lines and streaks disposed mainly in two longitudinal series: segment 1, spotless; segment 2, with a faint dot near the base on each side of the dorsal vessel, and a larger spot below the dot just above the main trachea, which spot is not represented in the other segments; in segments 3 to 9 the markings corresponding with the said dots take the forms of an oval spot in the 3rd segment, an abbreviated tapering streak in the 4th, a tapering streak produced to the hind margin in the 5th segment, and apparently continuous lines from the 6th to the 9th segment. Venter marked longitudinally, in segments 3 to 5 with two abbreviated tapering streaks; in segments 6 to 8 with two thin tapering lines; and in segment 9 with two linear stripes. Setæ ochraceous, with opaque joinings.

Dorsum of ♀ in segments 3 to 6 longitudinally bilineate, with an additional black line on each side in segments 7 to 9 parallel with and exterior to the principal lines in the hinder $\frac{3}{4}$ of each segment: on the pleura of most of the segments is a short marginal streak at the base, and a longer streak just inside the margin near the tip; on each side of the 2nd segment is an erect spot like a mark of exclamation. Hind wing spotless; neuriation indistinct to the naked eye.

Length of body 12; wing ♂ 12, ♀ 15–21; setæ ♀ subim. about 17 m. m. The specimens are infested with encysted parasites.

EPHEMERELLA sp.—

One ♀ subimago labelled “Kulu $\frac{5852}{5}$.”

EPEORUS PSI, Eaton.

Epeorus psi, Etn., Trans. Linn. Soc., 2nd Ser. Zool. iii. 242 (1835).

Two ♀ subimagos labelled “Kulu” respectively. The larger specimen measures:—wing 24, setæ about 35 m. m.

EPEORUS sp.—

One subimago labelled “Kulu $\frac{5349}{5}$.”